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Department of Energy

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

MAR 2 0 1997

Mr. Douglas R. Sherwood
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Blvd., Suite 5
Richland, Washington 99352

Mr. E. R. Skinnarland
200 Area Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336-6018

APR 1997 RECEIVED EDMC

Dear Messrs. Sherwood and Skinnarland:

RESOURCE CONSERVATION RECOVERY ACT (RCRA) CORRECTIVE MEASURES STUDY (CMS) FOR THE 200-PO-1 OPERABLE UNIT, DOE/RL-96-66, REV. 1

The subject document incorporates comments received from the State of Washington Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA). The document, and the comment responses are attached for your information. Comments related to the groundwater model used to evaluate risk were not addressed in this version. The document will be revised as necessary after the three parties complete modifications to the Hanford Site groundwater model. This approach was agreed to with the Ecology project manager for the 200-PO-1 Operable Unit.

If you have any questions or need further information, please feel free to contact me on 373-9630.

Sincerely,

Marvin J. Furman, Project Manager
Groundwater Project

GWP:DMW

Attachment

cc w/attach:
R. Jim, YIN
Z. Maine-Jackson, Ecology
R. Patt, Oregon DOE
D. Powaukee, NPT
J. Wilkinson, CTUIR
P. Zielinski, EM-442

cc w/o attach:
G. Henckel, BHI
M. Buckmaster, BHI
M. Todd, ITH

RESPONSES TO COMMENTS RECEIVED FROM EPA AND ECOLOGY ON THE CORRECTIVE MEASURES STUDY FOR THE 200-PO-1 OPERABLE UNIT, DRAFT A

December 18, 1996

General Comment Response: As agreed in the 200-PO-1 Data Quality Objectives (DQO) process, the modeling done for the Sitewide Groundwater Remediation Strategy was to be used to support the 200-PO-1 CMS. Therefore, the modeling questions would best be handled through the review process for the two model reports (calibration and prediction). The information presented in the 200-PO-1 CMS was not meant to be a defense of the model, but a presentation of the results and the implications for the 200-PO-1 Operable Unit. The sitewide modeling effort was to address the potential risks and impacts for other areas (e.g., tank farms), where in prior meetings, it was decided these other areas would not be covered as part of the 200-PO-1 CMS.

Specific Comment Responses

Page l-l, first parag:
Replace "in lieu of an RFI/CMS work plan"
Add: "without RFI/CMS work plan or additional field work because EPA, Ecology, and DOE agreed that sufficient information existed already from other programs.

Response: Comment accepted.

Page 1-1, first parag, line 10:
Add the Tritium document reference here

Response: Comment accepted.

Page 1-1, end of first parag:
This CMS looks at final not interim actions and in addition the source operable units may have other remedial actions.

Response: Comment rejected. This CMS cannot support a final RCRA decision when the sources have not been addressed. This was an agreement of the DQO process.

Page 1-1, parag 2, last sentence:
Explain and reference the idea that a ROD will document the 200 Area NPL site; explain relationship to RPP units etc.

Response: Comment accepted.

Page 2-2:
Add a section title "2.3.4 Other Contaminants"

Response: Comment accepted.

Section 3:
It is important to consider issues in the development and use of models. This CMS relies and extrapolates much of its content from the "Groundwater Remediation Strategy-Groundwater Contaminant Predictions " (BHI-000469) . There are many problems relating to the use of models in review of Superfund cleanup process such as:

* decision concerning when to use a model and which code to use (which is left to the discretion of the contractor)

* model does not account for all the processes affecting the fate and impact of the contaminants

* models lack accuracy when confronted with a high degree of heterogeneity (complex hydrogeology, multiple contaminants, two-phase flow and variable susceptibility in populations) and a long list of other components some of which this model exemplifies. Although the basic problem is not a lack of appropriate documents to guide the modeling process but a lack of training and experience in the people who are choosing and using models, deficiencies or limitations in the codes themselves, and scientific barriers that determine to what extent models are able to incorporate relevant processes. Where in the document or references is the quality assurance plan?

Response: Comment rejected. As agreed in the DQO process, the modeling done for the sitewide documents was to be the basis for the evaluation in the CMS. The model chosen for the sitewide study is an approved model for Hanford. The model incorporated all the available information from site geology, hydrology, groundwater monitoring data, and other sources. A DQO process for the model was held which was used instead of a formal quality assurance plan. This model gives an adequate representation for purposes of evaluating corrective measures for this CMS. Uncertainties of the model cannot be addressed through the CMS, but will be addressed through the sitewide document review process.

Page 3-1:
This groundwater model is not an approved model to be used at the Hanford Site. In addition the model has not be reviewed by Ecology.

Response: Comment rejected. VAM3D was evaluated and approved for use at Hanford as documented in *Description of Codes and Models to be Used in Risk Assessment* (DOE/RL-91-44) and *Groundwater Model Development Plan in Support of Risk Assessment* (DOE/RL-91-62).

Page 3-1, Second to last sentence:

Please add some words to the document that state that Ecology as a participant in the 200-PO-1 DQO wanted to participate in the model conceptual design through calibration phases. Ecology was not given this opportunity.

Response: **Comment rejected. Ecology was invited to participate in the DQO for the modeling (letter to Sherwood [EPA] and Stanley [Ecology] from Thompson [DOE] dated September 25, 1995.**

Page 3-2, first full parag:
Explain how a simplified numerical conceptualization led to more credible results. This is stated as a fact, when it is really more of an opinion. Documentation needs to be provided to support this statement.

Response: **Comment accepted in part. The statement implies that the most appropriate model is the one that addresses the investigation problem at the necessary level of detail to represent the physical system. In other words, the development of the numerical model should not exceed the quality of the input data and the conceptual understanding of the physical system. This will be clarified in the text.**

Page 3-2, Section 3.1.1:
No justification and appropriate references are provided for two key assumptions which include area of recharge from the surface due to precipitation (and related vadose contribution of contaminant to the groundwater) and communication between the unconfined and confined aquifers intercommunication being negligible. It is Ecology's opinion that the recharge from the surface can be significant in specific places and that overall across the site, over a period of 200 years it is an important component to the dynamics of the groundwater regime. This is supported by multiple recharge documents by PNNL and papers by Gee. Also see new information on recharge associated with the tank farms. This would indicate that the associated vadose zone contribution of contaminants to the groundwater is significant over the period of 200 years. See various Performance Assessments that are being performed in 200 Area - which potentially impact the groundwater in less than 130 years.

Response: **The calibration report (BHI-00608, Rev 0.) provides a completely referenced conceptualization of the groundwater flow regime on the Hanford Site. The model implements this conceptualization. The document primarily deals with the unconfined aquifer. For a completely referenced work on the basalt-confined aquifers underlying the Site, the commenter is referred to documents developed prior to and during work on the Basalt Waste Isolation Project and partially referenced in BHI-00608.**

Recharge due to direct infiltration of rainfall is minimal and is well documented at the Hanford Site by Gee, Johnson, USGS, and others. Direct infiltration in a shrub-steppe system is well known to allow only minimal recharge. Carbonate buildup in the soil, as seen in geologic logs and as noted during construction or other earth moving activities, provides additional

support to the above assertion. For most contaminants, calculations indicate that the quantity of contaminants already in the groundwater is higher than can be supported by simple infiltration and thus would be expected to decline with time, as the model predicts. Vadose contamination is likely to be a major contributor only in those areas where surface vegetation is removed, where vegetation cannot be supported (as in sand dunes), or where leakage from a man made source of water occurs.

Vertical flow in the basalts has been well documented to be severely limited by the hydrologic tightness of the basalt entablatures or interiors (measured at Hanford to be on the order of 10^{-12} cm/sec). This model assumed no basalt confined/unconfined aquifer interaction. A review of the potentiometric surfaces between the confined and unconfined aquifers indicates a potential for flow in both directions at different areas. However, insufficient information exists to quantify the extent to which the phenomena is occurring; therefore, the assumption of no flow is considered appropriate.

Page 3-4, parag 3:
The model is technically flawed because it assumes no recharge from precipitation, see above discussion. Also in Kennewick and Richland areas, studies have indicated that significant recharge also comes from precipitation on the basalt hills and subsequent runoff onto sedimentary units of the Ringold and Hanford Formations.

Response: **Comment rejected. Recharge from precipitation at the Hanford Site is primarily derived from channel infiltration of runoff occurring in the Cold and Dry Creek Areas. Recharge was taken into consideration by the boundary conditions that were used in the model.**

Page 3-4, parag 3, last sentence:
The statement about "groundwater data not revealing any significant contribution...." is incorrect and not valid. In fact sufficient data has been found in three tanks farms in East and West Areas to warrant the tanks going into RCRA groundwater assessment. The SX tank farms have impacted the groundwater with technetium, chromium, and potentially cesium. The plume related to the technetium can be detected in many groundwater wells. In addition, Gee has done significant work that demonstrates that the volume of water that recharges below a tank farm can be significantly increased due to the shadow/funnel effects created by the tanks themselves and the coarse gravel, non vegetated surface of the tank farms. The text should be corrected and new up to date information included.

Response: **Comment rejected. Groundwater recharge through direct infiltration is small in relation to past Hanford liquid waste disposal facilities. The current water tables cannot be supported by infiltration. Up to 5 billion gallons/year were discharged during operations. The groundwater system in 200 West and East is dropping at up to 1 foot/year with the cessation of discharge. The statement as stated is correct.**

A close evaluation of Gee's numerical modeling of SX tank farms indicates a conclusion that the potential exists to impact groundwater in certain situations, specifically where a mobile contaminant is released from the tanks from a relatively large leak with recharge being amplified through the shadow/funnel effect. Results from the SX study also showed contamination moving from the unsealed wells. His work is presented as a sensitivity analyses and not a conclusive work as the comment suggests. Gee notes that the model is neither calibrated nor verified with any field data.

Page 3-4, Section 3.1.2:
The calibration process is an exercise in "trial and error" where a set of model parameters are proposed, computed and measured values of head are compared and model parameters are adjusted to improve the fit. The results are used as a "quasi-independent" check on the model parameters arrived by the calibration. What were the steps in the model verification?

Response: **Comment accepted in part. The calibration of the model is described in the calibration report (BHI 1996b in the CMS reference list). This reference will be more prominently placed in Section 3.1.2.**

Page 3-5:
The modeling effort did not include the information about vadose zone contribution of tritium from vadose zone. As documented from the **ETF???????**

Response: **Effluent Treatment Facility reinjection at the State Approved Land Disposal Structure (SALDS) was included in the modeling.**

Page 3-5, parag 3:
Due to the extensive 14 year data base, was an alternative approach to calibration considered such as to solve the "inverse problem"?

Response: **Comment rejected. The large water table and tritium data bases collected through time were used to calibrate the model. Calibration is "solving the inverse" problem. A numerical optimizing scheme was not used as part of the calibration process.**

Page 3-7:
The impacts due to increased farming in upgradient areas is not analyzed with this model. Other site models utilize recharge in these areas.

Response: **Comment noted. The impact of upgradient farming was not considered. Over a 200-year prediction, a specific objective to help define the extent of farming and groundwater usage is needed.**

Section 3:
None of the other site models agree with the data generated from this modeling effort. This causes significant validation problems for this modeling effort. In addition, why spend

significant money adopting a totally new site model instead of adapting the site wide modeling performed by PNNL? And why not at least utilize the detailed hydraulic layering information and boundary conditions provided in PNNL's site wide model?

Response: **Comment noted. Every site wide modeling effort to date that the authors are aware of lacks the numerical, geologic, and hydrologic sophistication and completeness presented here. The "lack of agreement " can be associated with many causes, but in most cases it is because of assumptions made to be "conservative" and to save time. These assumptions limit the need to simulate the actual system as was done in this modeling effort.**

This modeling effort was an effort originally supported by DOE-RL, EPA, and Ecology with input from PNNL (DOE/RL-91-62); it began in 1991. The model was constructed as a result of TPA Milestones M-29-01 and M-29-02. This is the only model of the site capable of solving the advection and dispersion equations needed to simulate the transport of contaminants. The model was constructed due to the recognition that all existing models were inadequate to meet the needs of the ERC program. This condition has not changed.

The detailed layering and boundary conditions employed by the Draft PNNL model are not considered supportable by the data. It was the professional opinion of the modeling team that the field data could only support a two layer hydrologic layer model (embedded in a six layer geologic model). Additional layering was considered to be conjectural. The approach taken was to explain the observed behavior with the most supportable assumptions possible.

How is the model impacted by the groundwater divide that is created by the River to groundwater pumping in the Richland well field? How did you predict that the pumping will continue for 200 years? What does the analysis show if the pumping is stopped and the groundwater divide shifts, and do the presently contained plumes then move into the Richland area?

Response: **Comment noted. The modeling did not include the Richland well field mounding, which would only be a blip given the scale of the model. By not including it, the model is demonstrating the worst case for contaminant movement into this area. As seen in the model, this is not an issue. Predictions indicate that between 50 to 100 years the flow system takes a more west to east direction and the southern component of flow dampens. The contaminants associated with 200-PO-1 are within acceptable levels, as shown by the model, in less than 50 years. An assumption of maintaining this pumping field for 50 years is not unrealistic. As agreed in a meeting between DOE, Ecology, and BHI, this document was to address only 200-PO-1 contaminants.**

Tables 3-l, through 3-3:
Provide the dispersivity used and the justification and references for dispersivity used.

Response: Comment accepted in part. This information is contained in the modeling report; this will be referenced in the CMS.

Page 4-2. parag l, line 3:
The information from the DQO on the hierarchy is misrepresented - please review DQO notes and correct.

Response: Comment accepted.

Page 4-2. Section 4-3, bullet l:
What about MTCA standards for arsenic?

Response: Comment noted. The MTCA standards for arsenic are discussed in new Section 2.3.4 (Section 2.3.3 in Draft A). Because the arsenic values under MTCA are significantly lower than the background, they were not reiterated in Section 4.

Section 5:

Significant information is missing from this section as follows:

* There is no Limited Ecological Risk Assessment provided as discussed in many meetings.

* The potential risk to the 400 Area water supply is not discussed.

* Potential contaminant impacts and associated risk to the Richland wells are not identified.

* The impact of the Richland well field induced groundwater divide is not discussed. What are the risks if the well field divide shifts during the next 200 years?

Although this risk evaluation is qualified as a screening analysis, it should also include some cursory assessment of ecological receptors. It is important to consider ecological risks, as well as human risks, since there are cases in which contaminants are likely to present significant risks to ecological receptors at lower environmental concentrations than for humans due to differences in stressor characteristics (e.g., type, intensity, duration, frequency, timing, scale, and mode and action).

In addition, the risk evaluation should include at least a qualitative assessment of uncertainty in the risk estimates. Uncertainty can be examined in different ways. For example, uncertainty can be categorized in terms of parameter uncertainty, model uncertainty, decision-rule uncertainty, and variability (Finkel, A. 1990. Confronting uncertainty is risk management: A guide for decision-makers. Center for Risk Management, Resources for the Future, Washington, DC). An analysis of uncertainty can improve the qualify of risk management actions, such as establishing cleanup standards, selecting among identified remedial options, and communication with the public.

Response: **Comment accepted in part. Some qualitative evaluation of potential risks at the 400 Area and Richland wells will be included. An uncertainty section will be added. Some qualitative ecological risk estimates will be made for the contaminants at the river along with a discussion of potential receptors and pathways.**

Page 5-l, parag l:
It should be emphasized more that the cumulative risk estimates were derived only from exposure pathways associated with groundwater. Pathways associated with other media (e.g., soil) were not considered here.

Response: **Comment accepted. This will be clarified in the text.**

Page 5-1, parag 3:
Apparently, iodine-129 and tritium were the only carcinogenic contaminants analyzed to determine cumulative cancer risk. It appears that arsenic and strontium-90 in the 200 Area may also contribute significantly to cumulative cancer risk, since these contaminants exceed MTCA Method B and MCL levels, respectively (see page 2-3). Arsenic concentrations exceeds 1E-6 cancer risk, since carcinogen concentrations greater than MTCA Method B levels exceed a 1E-6 cancer risk level. MCLs for carcinogens do not necessarily correspond to a fixed cancer risk level, however, since these standards also reflect treatment technology, quantification limits, and cost. In addition to tritium, iodine-129, arsenic, and strontium-90, nitrate may contribute to cancer risk as a result of in vivo conversion of nitrate to nitrosamines.

Response: **Comment accepted in part. The risks associated with one or two well contaminants are insignificant given the overall size of the operable unit. These risks would show up as pinpoints on the map. They may, however, be more appropriately addressed through the source operable unit process and individual TSD evaluations. Arsenic is fairly wide spread in the southern portion of the 200 East at a relatively constant concentration just slightly above the Hanford Site background. While the contaminant concentrations may exceed MTCA, the MTCA values are significantly below the background. Per the DQO, it was agreed that in this instance, the background value would become the cleanup goal. This information will be clarified in the text.**

Page 5-1, parag 4:
Similarly, it is not clear whether nitrate is the only contaminant contributing significantly to non-cancer effects. For example, vanadium (and possibly arsenic) concentrations exceed the MTCA Method B level (see page 2-3). Noncarcinogen concentrations greater than MTCA Method B levels exceed a reference dose or hazard quotient of 1.0.

The statement on ecological risks infers that some type of ecological assessment was conducted on modeled contaminant concentrations at the river's edge. Clearly, there is no ecological risk assessment presented in this report. A screening ecological risk assessment should be performed, however, since several pathways may expose biota to groundwater contaminants (e.g., uptake by vegetation, wildlife ingesting water from seeps and springs, etc.).

Response: **See response to previous comment. Some ecological calculations for tritium and iodine-129 for areas near the river will be included along with a discussion of potential receptors and exposure parameters.**

Page 5-1, parag 5:
Note that plume migration is influenced not only by Kd but also groundwater flow rate.

Response: **Comment accepted. This will be noted in the text.**

The unit risk factors (URFs) are derived not only from the Hanford Site Risk Assessment Methodology (HSRAM), as stated, but also from a source in the literature containing radionuclude slope factors (e.g., EPA's Health Effects Assessment Summary Tables [HEAST]).

Response: **Comment accepted. Additional references will be included.**

Page 5-2, parag 3:
Note that use of a composite individual (i.e., 24 yr exposure as an adult and 6 yr exposure as a child) is a departure from HSRAM for groundwater pathways in the industrial and residential exposure scenarios. Departures should be explicitly stated.

Response: **Comment accepted in part. The statement will be removed because it is not applicable to radionuclides.**

Page 5-2, parag 4:
Similarly, ingestion of shower water is not specified in HSRAM for either industrial or residential scenarios. Although these departures from HSRAM may be appropriate, they should be identified.

Response: **Comment accepted. The information was not taken only from HSRAM, but also from the HRA-EIS. This will be added to the text.**

Page 5-2, parag 6:
It is stated that unit concentrations of 1 mg/L (contaminant in groundwater) were used in calculations. The text should also state that unit concentrations of 1 pCi/L were used for radionuclides (presuming this is the case), since tritium and iodine-129 are among the contaminants of concern.

It should be clarified that URFs are summed across relevant groundwater pathways (e.g., ingestion, inhalation, dermal contact), so that when URFs are multiplied by contaminant concentration, an estimate of risk is obtained for that contaminant for all pathways associated with groundwater.

Response: Comment accepted. This section will be clarified to state that the URFs are from the HRA-EIS; a table will be included showing the different pathways and the summation to a single value.

Page 5-3, parag 1:
This paragraph seems entirely nonsensical to me in the context of the report. This is , values specified for the oral and inhalation slope factors and dermal permeability coefficient are those for chloroform. What is going on? Chloroform is not even one of the contaminants of concern in this analysis.

Response: Comment accepted. The paragraph will be deleted.

Page 5-3, parag 2:
I presume that the constant contaminant concentrations assumed over the chronic exposure duration are the average concentrations over the time period which take into account radioactive decay (e.g., tritium concentrations will be reduced considerable over 30 years). Clarify.

Response: Comment accepted in part. The risk calculations used point estimates of modeled concentrations. No adjustment was made for changing concentrations during the lifetime of the exposed individual. Risk estimates are however shown at multiple points in time. This will be clarified in the text.

Page 5-3, parag 3:
It would be useful to present measured tritium and iodine-129 groundwater concentrations, so that the reader can better judge the uncertainty in the modeled isopleth data. This would reveal the spatial and temporal extent of the measured data, so that data extrapolations (i.e., modeled isopleth data) would be clearly viewed as such. One consequence of extrapolating groundwater concentration data (and therefore cancer risk data) is that the accuracy of the calculated cumulative cancer risk is largely overstated. An analysis of uncertainty would add perspective to this problem.

Response: Comment accepted in part. An uncertainty section will be added. References to the RFI for concentration maps will be included.

Page 5-3, parag 4:
It would be useful to reference URFs (Table 5-1) and tritium and iodine-129 modeled concentration data (Figures 3-9 and 3-16) to support the statement that tritium initially contributes more significantly to cumulative cancer risk than does iodine-129.

Response: Comment accepted.

Page 5-3, parag 6:

The statement in this paragraph would be supported more clearly by linking cancer risk with concentrations via URFs. For example, if residential URFs (Table 5-l) are multiplied by cleanup levels (Table 4-l), cancer risks of 2.5E-5 and 5.6E-6 are obtained for tritium and iodine-129, respectively. Cumulative cancer risks displayed in Figures 5-4 and 5-5 are predominantly below the summed cancer risk (3.lE-5) associated with these cleanup levels.

Response: Comment accepted.

Page 5-3, parag 8:
According to Figures 5-3 through 5-5 for residential scenarios, there are still groundwater areas exceeding lE-5 cumulative cancer risk which corresponds to the MTCA Method B allowable site risk. Therefore, it may be appropriate to estimate risk for the recreational scenario, as well. Furthermore, the residential scenario may not be the most conservative scenario, considering possible exposure pathways characteristic of Native American inhabitants in the area (e.g., see Napier, BA et al. 1996. Human scenarios for the screening assessment: Columbia River Comprehensive Impact Assessment. DOE/RL-96-16-a).

Response: **Additional discussion required. In Figures 5-4 and 5-5, the areas above 1E-5 are attributable to the 200 West Area contaminants, which Ecology agreed were not to be included in the 200-PO-1 discussion. The Native American scenario was not identified in the DQO. For purposes of responding to this comment, calculations were made using the cited reference to estimate the risk under this scenario. The calculations are included as an attachment to this comment response document. These are for illustrative purposes only and are not incorporated into the document. The unit risk factors calculated under the Native American scenario of subsistence resident are 3.65E-09 risk L/pCi for tritium and 9.4E-06 risk L/pCi for iodine-129. URFs used in the CMS for the residential scenario were 1.25E-09 risk L/pCi for tritium and 5.63E-06 risk L/pCi for iodine-129. For nitrate, a hazard quotient of 0.1 was estimated for the target population of children. This is explained on the attached nitrate calculation sheet. This calculation is based on parameters specific to ingestion by children and is not included in the Native American scenario. Using the parameters in the Native American scenario, the hazard quotient for nitrate is calculated as 2.55E-04.**

Page 5-4, parag 2:
Nitrate in groundwater was flagged as a contaminate of concern by hazard index screening (as stated), as well as by aquatic biota toxicant screening, according to the cited PNNL report (Napier et al. 1995. Identification of contaminants of concern: Columbia River Comprehensive Impact Assessment. PNL-10400, UC-630). The cited PNNL report also identifies strontium-90 and chromium as contaminants of concern in groundwater.

When converting radiation dose (mrem/yr) to risk, it would be helpful to show the EPA radiation risk factor (3.9E-7 risk/mrem for fatal cancers). Also, it might be instructive for comparative purposes to multiply the calculated annual individual risk (lE-8/yr) by a 70 yr lifetime to estimate a lifetime cancer risk (7E-7).

Response: **Strontium-90 and chromium, as 200-PO-1 contaminants, are confined to the 200 East Area. These contaminants at the springs are likely from some sources in the 100 and 300 Areas. The lifetime cancer risk will be included.**

Pages 5F-l through 5F-5
In Figures 5-l through 5-5, isopleths of risk are useful for visually displaying risk levels. However, isopleths give the illusion of greater accuracy than is warranted. Again, there should be discussion on the uncertainty associated with risk estimate, at least in a qualitative sense.

Response: **Comment accepted.**

Page 5F-5
In the figure title, the year should read "2195" (not "2129") for T=200 years.

Response: **Comment accepted.**

Page 5T-l
URFs should have dimensions "risk per pCi/L". The manner in which URF units are presented in the table is confusing. Again, it should be clarified that pathway-specific URFs are summed across all relevant groundwater pathways to yield the industrial and residential URFs in the table (presuming this is the case).

I cannot reconcile URF values in the table with my own calculations. Therefore, it would be helpful to show calculations for deriving URFs. What is the literature source of radionuclide slope factors? For example, EPA's HEAST (May 1995) lists an ingestion slope factor for tritium of 7.15E-14 risk/pCi. The URF for tritium for ingesting groundwater in the industrial scenario would be calculated as follows:

URF=(7.15E-14 risk/pCi) (1 L/day) (250 days/yr) (20 yr) = 3.58E-10 risk per pCi/L

This calculated URF is only for one pathway (i.e., groundwater ingestion) yet it exceeds the corresponding industrial URF for tritium listed in the table (2.71E-10) which presumably accounts for all groundwater pathways. An analogous situation exists for the residential URF for tritium. Please clarify these discrepancies.

Response: **Comment accepted. The units will be corrected. The slope factors used for the URF were taken from the HRA-EIS work and differ from HEAST. This will be noted in the text.**

Why is a footnote for "TCE" included? There is no TCE in the table.

Why are "Source" and "Remediation Scenario" included in the table? What purpose does this information service, especially when it is labeled "N/A?"

Response: **Comment accepted. The columns and footnote will be removed.**

Page 5T - 2
Although the listed pathways appear appropriate, Table 5-2 should note departures from HSRAM. For example, shower water ingestion is not specified in HSRAM for either industrial or residential scenarios. For radionuclides in particular (e.g., tritium, iodine-129), shower dermal absorption is not specified in HSRAM.

Response: **References to both HSRAM and the HRA-EIS will be included because both were used in the risk evaluation.**

Page 5T-3
In general, information presented in Table 5-3 is helpful in understanding the analysis. The table title should specify that these exposure parameters are associated with groundwater pathways in this application. Note that body weight and averaging time apply only to nonradioactive contaminants and are not used in the calculation of radionuclide intakes. It should be clarified again here that fruit and vegetables consumed are irrigated with groundwater.

Several other clarifications should be added, primarily relating to compatibility with HSRAM. For chemical noncarcinogens (e.g., nitrate), HSRAM specifies groundwater ingestion as 1 L/day for a 16 kg child over a 6 yr exposure duration in the residential scenario. Shower frequency, shower duration, and skin area are specified in HSRAM only for nonradioactive contaminants. Shower water ingestion is not specified in HSRAM for either industrial or residential scenarios. The indoor air volatilization factor for radionuclides specified by HSRAM is the water volatilization factor for radon (0.1 L/m^3). This value should be described and added to the table.

Response: **Comment accepted. Footnotes will be added for clarity.**

Page 5F-5, Figure 5-5:
The contouring must be labeled wrong on this figure. See the two contours labeled lE-5.

Response: **Additional discussion required as this is not the case on the master copy of the figure.**

Page 5T-l, Table 5.l:
Justify and explain why only carcinogenic risk are considered?

Response: **Comment accepted. This will be justified.**

Page 6-2, bullet 2:
The idea about pumping the high concentration portions of the plumes should be further explored in a true CMS fashion. More efforts needs to be put into the analysis of this option. The benefits should be analyzed and the cost should be defined. Simply stating that the "it may be viable option" ...." then stating that the cost may be prohibitive" is not sufficient analysis.

Response: **Additional justification will be added.**

Page 6-11, number 2 indent:

Alternative 2- Institutional Controls must include controlled access to springs to protect people and wildlife. It must also include RCRA groundwater monitoring for the RPP unit.

Response: **Comment accepted. This will be clarified in the text.**

Page 7-1, Section 7.2.2:
Alternative 2-Institutional Controls must include controlled access to springs to protect people and wildlife. It must also include RCRA groundwater monitoring for RPP unit.

Response: **Comment accepted. This will be clarified in the text.**

Page A-5, parag 1:
Please delete the words "mini CERCLA statue"

Please add "which applies to 200-PO-1 operable unit" to the last sentence in the first paragraph.

Response: **Comment accepted.**

Sections 4 and 5 of Appendix A:

These sections are inadequate and a meeting should set with contractor, DOE and Ecology to work through a path forward on these sections. Specific problems include:

* no monitoring of high concentration areas is included,

* and no protection monitoring is provided for the 400 Area supply wells located Richland.

Response: **This was a recommended monitoring program. DOE will take an action to set up a meeting.**